REMARKS

Claims 1, 6, 14, 15, 16, 17, 18, 20, 21, 22, 24, 25, 26, 29, 37 and 50 have been amended. Claims 19, 32, 40 and 51 have been cancelled without prejudice to their underlying subject matter, which has been incorporated into respective independent claims 1, 29 and 50. Claims 54-97 have been added for consideration. Attached hereto is a marked-up version of the changes made to the claims. Claims 1-4, 6-18, 20-31, 34-39, 41-44 and 50, 52-97 are pending in this application.

Claims 15, 25 and 26 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Claims 15 has been amended to depend from claim 1 and should be considered allowable. Claim 25 depends from claim 15 and claim 26 depends from claim 25. Therefore, claims 25 and 26 should also be considered allowable. Claim 6 has similarly been amended, although not rejected under § 112, second paragraph. In view of the amendment to claims 6 and 15, Applicants respectfully request that this 35 U.S.C. § 112, second paragraph, rejection of claims 15, 25 and 26 be withdrawn.

Claims 1-4, 6, 14, 16-18, 20 and 22 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. patent number 6,277,733 (Smith). (The Office Action stated that these claims were rejected under 35 U.S.C. § 103(a), but upon communication with the Examiner, it has been verified that the rejection is under 35 U.S.C. § 102(e).) Applicants respectfully traverse this rejection.

Claim 1, as amended, defines a method for removing polymer etch residue from an etched opening in a silicon wafer device and recites "forming an opening in an insulating layer, wherein a polymer etch residue remains within said opening after the opening forming step" and "contacting said opening with a plasma to remove said polymer etch residue, said plasma generated from a gas consisting essentially of ammonia." Smith does not anticipate this claimed method.

Smith discloses that to create its trench or via opening, an etching process is "performed using CHF_3, CF_4 or other fluorinated hydrocarbon plasma chemistry." (column 4, lines 1-2). Smith also discloses a clean-up step to remove any polymer by subjecting the wafer to "a plasma which contains H_2 . . . and CF_4." (column 4, lines 33-36) (emphasis added). Smith does not teach or suggest the use of a "plasma generated from a gas consisting essentially of ammonia," as amended claim 1 recites (emphasis added). Thus, for at least this reasoning Smith does not anticipate claim 1.

Since Smith does not anticipate independent claim 1, claims 2-4, 6 and 14 depending from it are likewise patentable thereover. Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 1-4, 6 and 14 be withdrawn.

Claim 16, as amended, defines a method for removing polymer etch residue from an etched opening in a silicon wafer device and recites "contacting said opening with an oxygen containing plasma, stopping said oxygen plasma contact before said polymer etch residue is completely removed and thereafter contacting said opening with a second plasma, said second plasma generated from a hydrogen containing gas." Smith does not anticipate this claimed method.

Smith discloses the use of oxygen only for the step of removing a photoresist layer. (column 3, lines 36-38). Smith teaches that "[t]he standard O_2 strip process to remove the photoresist will form an extremely thick Cu-oxide layer and, therefore should not be utilized to strip the photoresist." (column 3, lines 42-45) (emphasis added). Indeed, the title of Smith's very invention defines an "oxygen-free, dry plasma process for polymer removal." (Title). Furthermore, Smith does not teach or suggest (and in fact teaches away from) "contacting said opening with an oxygen containing plasma," as claim 16 recites (emphasis added). Thus, Smith does not anticipate claim 16 as amended.

Since Smith does not anticipate independent claim 16, claims 17, 18, 20 and 22 depending from it are likewise patentable thereover. Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claims 16-18, 20 and 22 be withdrawn.

Claims 7-13, 21, 23, 24, 27 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith alone or Kawai in view of Smith. (Since no patent number was cited for Kawai, Applicants shall hereinafter infer that Office Action referred to U.S. patent number 6,284,664 (Kawai) when referencing "Kawai"). Applicants respectfully traverse this rejection.

The subject matter of claims 7-13, 21, 23, 24, 27 and 28 would not have been obvious over Smith or Kawai in view of Smith. Indeed, the Office Action fails to establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. More importantly, the teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on Applicant's disclosure. M.P.E.P. § 2142. See, e.g., In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974).

In considering any patent as a reference for 35 U.S.C. § 103 purposes, it must be considered as a whole, including any teaching away, and further it must suggest the desirability and obviousness of combining it with the other reference. (M.P.E.P. §§ 2141.01 and 2141.02 (2001)) (emphasis added). In accordance with M.P.E.P. § 2144.05.III, a prima facie case of obviousness is rebutted by showing that a reference, in any material respect, teaches away from the claimed invention. M.P.E.P. § 2144.05.III (2001) (emphasis added), citing In re Geisler, 116 F.3d 1465, 1471, 43 U.S.P.Q.2d 1362, 1366 (Fed. Cir. 1997). "A prior art reference that 'teaches away' from the claimed invention is a significant factor to be considered in determining obviousness." M.P.E.P. § 2145.X.*D*.1 (2001). "References cannot be combined where [a] reference teaches away from their combination" for the purposes of supporting a rejection under 35 U.S.C. § 103(a). Id. At X.*D*.2. Smith does not teach or suggest the claimed method and, in fact,

teach away from the claimed method and is, therefore, an improper reference for use in rejecting the claims under 35 U.S.C. § 103(a).

Claims 7-13 depend from claim 1, already discussed above. First, Smith and Kawai, whether considered alone or in combination, do not teach or suggest all the limitations of amended claim 1. Claim 1, as amended, recites removing polymer etch residue from an opening by "contacting said opening with a plasma to remove said polymer etch residue, said plasma generated from a gas consisting essentially of ammonia." Neither Smith nor Kawai teach or suggest the use of a "plasma generated from a gas consisting essentially of ammonia," as claim 1 recites (emphasis added). Smith discloses a clean-up step "to remove any polymer that is formed on the sidewalls of the via or the trench." (column 4, lines 27-29). According to Smith, "the wafer would be subjected to a plasma which contains H_2 . . . and CF_4." (column 4, lines 33-35) (emphasis added). Thus, Smith does not teach the claimed method. Kawai also does not teach or suggest the use of a gas consisting essentially of ammonia. Kawai relates to a method of forming a semiconductor device including a step of removing an organic layer deposited at the bottom of the contact holes "through the use of a plasma of a mixed gas consisting of CF_4 and O_2." (See, e.g., Abstract). Thus, like Smith, Kawai does not disclose the claimed method.

Second, there is no suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify Kawai or combine the teachings of Smith and Kawai to achieve the subject matter claimed. Kawai discloses the elimination of an organic layer through the use of "a cleaning gas containing CF_4 and O_2." (column 4, lines 44-45). By contrast, Smith specifically teaches against the use of oxygen. When removing "the photoresist and any polymer formed on the sides of the via or the trench, the top of conductor 420, the surface of the dielectric 430, and any remaining portions of the barriers 420 and 426," Smith states that "the traditional oxygen photoresist strip should not be performed." (column 4, lines 10-16) (emphasis added). In this respect, Smith teaches away from Kawai. Accordingly, a person skilled in the art would not have been motivated to combine Smith and Kawai.

Since Smith and Kawai do not teach or suggest all the claim limitations of claim 1 and since there would have been no motivation to combine Smith and Kawai, the subject matter of independent amended claim 1 and its depending claims 7-13 would not have been obvious over these references. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 7-13 be withdrawn.

Claims 21, 23, 24, 27 and 28 depend from claim 16. Claim 16, as amended, recites contacting an "opening with an oxygen containing plasma, stopping said oxygen plasma contacting before said polymer etch residue is completely removed and thereafter contacting said opening with a plasma, said plasma generated from a hydrogen containing gas." Smith teaches away from claim 16 as noted above. Smith does not teach or suggest (and is actually teaching away from) contacting an etched opening in a silicon wafer device "with an oxygen containing plasma," as recited in claim 16. To the contrary, Smith discloses the use of oxygen only for the step of removing a photoresist layer (and actually discourages this) and teaches that "the traditional oxygen photoresist strip step should not be performed" in the step of removing "any polymer formed on the sides of the via or the trench, the top of conductor 420, the surface of the dielectric 430, and any remaining portions of the barriers 420 and 426." (column 3, lines 36-38; column 4, lines 12-16).

Kawai discloses the elimination of an organic layer through the use of "a cleaning gas containing CF_4 and O_2." (column 4, lines 44-45). Kawai does not teach or suggest "stopping said oxygen plasma contacting before said polymer etch residue is completely removed and thereafter contacting said opening with a second plasma, said second plasma generated from a hydrogen containing gas," as recited in claim 16.

Since Smith teaches that oxygen should not be used in the step of removing polymer etch residue, Smith teaches away from both Kawai and claim 16 and its dependent claims. Therefore, and at least for similar reasoning to that set forth above relating to claims 7-13, the subject matter of independent claim 16 and its respective depending claims 21, 23, 24, 27 and 28 would not have been obvious over Smith and Kawai. Applicants

respectfully request that the 35 U.S.C. § 103(a) rejection of claims 21, 23, 24, 27 and 28 be withdrawn.

Claims 29-31, 34-38 and 41-44 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawai in view of Smith. Applicants respectfully traverse this rejection.

Claim 29, as amended, defines a method for removing polymer etch residue from an etched opening in a silicon wafer device and recites "contacting said opening with an oxygen plasma to remove a portion of said etch residue" and "cleaning etch residue from said etched opening by contacting said opening with a plasma generated from a hydrogen containing gas in the absence of added oxygen." Kawai and Smith, whether considered individually or in combination, do not teach or suggest the method of claim 29.

Neither Smith nor Kawai teach or suggest "contacting said opening with an oxygen plasma to remove a portion of said etch residue" and "cleaning etch residue from said etched opening by contacting said opening with a plasma generated from a hydrogen containing gas in the absence of added oxygen." Kawai discloses a step for "eliminating an organic layer deposited at the bottom of the contact hole, through use of a cleaning gas plasma containing a halogen-based gas selected from the group comprising CF_4, CI_2, CHF_3, SF_6, and NF_3 <u>and</u> an oxygen containing gas selected from the group comprising O_2, N_2O, CO_2, O_3, H_2O_2, and H_2O." (column 2, lines 52-58) (emphasis added). Kawai does not teach or suggest "cleaning etch residue from said etched opening by contacting said opening with a plasma generated from a hydrogen containing gas <u>in the absence of added oxygen</u>," as amended claim 29 recites (emphasis added). Smith discloses a method including a step of removing photoresist and any polymer residue and specifically states that "oxygen photoresist strip step should not be used in this case." Smith does not teach or suggest (and in fact <u>teaches away</u> from) "contacting said opening with an oxygen plasma to remove a portion of said etch residue," as claim 29 recites.

Additionally, there is no suggestion or motivation to modify Kawai or combine the teachings of Smith and Kawai. Kawai discloses the elimination of an organic layer through the use of "a cleaning gas containing CF_4 and O_2." (column 4, lines 44-45). By contrast, Smith specifically teaches against the use of oxygen. When removing "the photoresist and any polymer formed on the sides of the via or the trench, the top of conductor 420, the surface of the dielectric 430, and any remaining portions of the barriers 420 and 426," Smith states that "the traditional <u>oxygen photoresist strip should not be performed</u>." (column 4, lines 10-16) (emphasis added). In this respect, Smith teaches away from Kawai. Accordingly, there is no motivation to combine the teachings of Smith and Kawai.

Since Smith teaches that oxygen should not be used in the step of removing polymer etch residue, Smith teaches away from claim 29 and its dependent claims. Since Smith and Kawai do not teach or suggest all claim limitations of claim 29 and since there exists no motivation for a person skilled in the art to combine Smith and Kawai, the subject matter of independent amended claim 29 and its depending claims 30, 31, 34-38 and 41-44 would not have been obvious over its references and should be considered allowable. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 29-31, 34-38 and 41-44 be withdrawn.

Claims 1 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawai in view of Smith, Hamada and Hopper. (Since no patent number was cited for Hamada and Hopper, Applicants shall hereinafter infer that Office Action referred to U.S. patent number 6,291,890 (Hamada) when referencing "Hamada" and U.S. patent number 6,030,901 (Hopper et al.) when referencing "Hopper"). Applicants respectfully traverse this rejection.

For at least the same reasoning set forth above regarding the patentability of claim 1 as not anticipated by Smith, Smith would not have rendered its subject matter obvious. The disclosure of Kawai, Hamada and Hopper cannot supplement the

inadequacies of Smith in this regard, even if Smith did not teach away from this claimed invention and from its combination with other references.

Kawai, Hamada, Smith and Hopper, considered individually or in combination, do not teach or suggest a method for removing polymer etch residue from an etched opening by "contacting said opening with a plasma to remove said polymer etch residue, said plasma generated from a gas consisting essentially of ammonia," as recited by claim 1. Kawai discloses use of a "cleaning gas containing CF_4 and O_2" (column 4, lines 45) and not a "plasma generated from a gas consisting essentially of ammonia" to eliminate the organic layer that is deposited during the etching step, as amended claim 1 recites (emphasis added). Hamada relates to a "semiconductor device having a silicide structure and, more particularly to an improved silicide structure using a semi-insulating polycrystalline silicon film." (column 1, lines 10-14). Hamada is entirely silent on "contacting said opening with a plasma to remove said polymer etch residue," as recited by claim 1. As mentioned above, Smith teaches "the wafer would be subjected to a plasma which contains H_2 . . . and CF_4." (column 4, lines 33-35). Smith does not teach the use of a "plasma generated from a gas consisting essentially of ammonia," as claim 1 recites (emphasis added). Hopper et al. is directed to a process of photoresist stripping so as not to increase the dielectric constant of an exposed carbon-containing dielectric material (i.e., a polymeric layer). (Abstract; column 2, lines 49-50). The process of Hopper et al. involves a different step in semiconductor processing from the claimed "contacting . . . to remove polymer etch residue" step. The Hopper et al. process begins and ends at the removal of a photoresist used to mask a carbon-containing dielectric layer, which can itself be a polymer. (column 4, lines 43-49). Thus, none of these references teaches or suggests the subject matter claimed.

Additionally, Hopper et al. teaches away from the claimed method because the stated goal of Hopper et al. is to not effect the carbon-containing dielectric material, which can be a polymer layer, upon etching to remove the photoresist thereover. (column 3, lines 40-43; column 4, lines 43-49; column 5, lines 13-17). Hopper et al. specifically states that

this process of <u>not effecting</u> (i.e., effecting by increasing the dielectric constant or removing) the dielectric (i.e., polymer) "is applicable to a wide variety of low dielectric constant carbon-containing materials . . . include[ing] various polymers." (column 5, lines 13-17 and 61-62). Hopper et al. indicates that its process <u>does not have any impact on polymers</u>. By contrast, the claimed method is directed to removing a polymer etch residue with a plasma etching step; directly inapposite to the disclosed process of Hopper et al. Since the Hopper et al. process is disclosed as not effecting polymers, the claimed method is not taught or suggested by Hopper et al. In this regard, Hopper et al. <u>teaches away</u> from the claimed invention, rendering Hopper et al. an improper reference for rejecting the claims.

Because Hopper specifically teaches away from the combination of with Kawai, Hamada and Smith, and even if combined, these references would not have rendered the subject matter of claim 1 and depending claim 15 obvious, claims 1 and 15 are patentable over these references taken individually or in combination. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 1 and 15 be withdrawn.

Claims 25, 26, 39 and 50, 52 and 53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawai in view of Smith, Hamada and Hopper. Applicants respectfully traverse this rejection.

Claims 25 and 26 depend from claim 16. For at least the same reasoning set forth above regarding the patentability of claim 16 as not anticipated by Smith, Smith would not have rendered its subject matter obvious. The disclosure of Kawai, Hamada and Hopper cannot supplement the inadequacies of Smith in this regard, even if Smith did not teach away from this claimed invention and from its combination with other references.

Kawai, Hamada, Hopper and Smith, considered individually or in combination, also do not teach or suggest "contacting said opening with an oxygen containing plasma, stopping said oxygen plasma contacting before said polymer etch residue is completely removed and thereafter contacting said opening with a plasma, said plasma generated from

a hydrogen containing gas," as claim 16 recites. Kawai does not teach or suggest "stopping said oxygen plasma contacting before said polymer etch residue is completely removed," much less "thereafter contacting said opening with ammonia gas," as claim 16 recites. As mentioned above, Hamada is entirely silent on "contacting said opening with an oxygen containing plasma" and subsequently "contacting said opening with a plasma," as claim 16 recites. As discussed above, the Hopper process is disclosed as not effecting polymers. Therefore, the claimed method is not taught or suggested by Hopper (and in fact Hopper teaches away from the claimed invention, rendering Hopper an improper reference for rejecting the claims). As also discussed above, Smith also teaches away from the claimed invention. Smith discloses the use of oxygen only for the step of removing a photoresist layer (and even discourages this) and discloses that "the traditional oxygen photoresist strip step should not be performed" in the step of removing "any polymer formed on the sides of the via or the trench, the top of conductor 420, the surface of the dielectric 430, and any remaining portions of the barriers 420 and 426." (column 3, lines 36-38; column 4, lines 12-16). Smith's disclosure is contrary to claim 16, which recites "contacting said opening with an oxygen containing plasma, stopping said oxygen plasma contacting before said polymer etch residue is completely removed."

Because Smith and Hopper specifically teach away from the combination of Kawai and Hamada, and even if combined, these references would not have rendered the subject matter of claim 16 and depending claims 25 and 26 obvious, claims 16, 25 and 26 are patentable over these references taken individually or in combination. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 16, 25 and 26 be withdrawn.

Claims 39 depends from claim 29. For at least the same reasoning set forth above regarding the patentability of claim 29 as not anticipated by Smith and as not obvious over Kawai in view of Smith, Smith would not have rendered its subject matter obvious. The disclosure of Kawai, Hamada and Hopper cannot supplement the

inadequacies of Smith in this regard, even if Smith did not teach away from this claimed invention and from its combination with other references.

Kawai, Hamada, Hopper, and Smith, considered individually or in combination, do not teach or suggest "contacting said opening with an oxygen plasma to remove a portion of said etch residue" and "cleaning etch residue from said etched opening by contacting said opening with a plasma generated from a hydrogen containing gas in the absence of oxygen," as claim 29 teaches. Kawai does not teach or suggest "cleaning etch residue from said etched opening by contacting said opening with a plasma . . . in the absence of oxygen." Hamada is entirely silent on "cleaning etch residue from said etched opening," as claim 29 recites. As discussed above, Hopper teaches away from the claimed invention, rendering Hopper an improper reference for rejecting the claims. As also discussed above, Smith teaches away from the claimed invention.

Because Smith and Hopper specifically teach away from the combination of Kawai and Hamada, and even if combined, these references would not have rendered the subject matter of claim 29 and depending claim 39 obvious, claims 39 is patentable over these references taken individually or in combination. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claim 39 be withdrawn.

For at least the same reasoning set forth above regarding the patentability of claims 1, 16 and 29 as non-obvious over Smith, Smith would not have rendered the subject matter of claim 50 as obvious. The disclosure of Kawai, Hamada and Hopper cannot supplement the inadequacies of Smith in this regard, even if Smith did not teach away from this claimed invention and from its combination with other references.

Kawai, Hamada, Hopper, and Smith, considered individually or in combination, do not teach or suggest a method for removing polymer etch residue from an etched opening by "removing polymer residue from said contact opening using a plasma consisting essentially of ammonia gas which provides an oxide free bottom of said contact opening, wherein said gas for removing said polymer residue is ammonia gas and opening is

not substantially increased in size," as recited by amended claim 50. As discussed above, Kawai does not teach or suggest using an ammonia gas to eliminate the organic layer that is deposited during the etching step. Hamada is entirely silent on "removing polymer residue from said contact opening" as claim 50 recites. As discussed above, the Hopper process is disclosed as not effecting polymers. Therefore, the claimed method is not taught or suggested by Hopper. Indeed Hopper teaches away from the claimed invention. As noted above, Smith uses a fluorine-containing plasma which would increase the size of the via substantially, thus, Smith also teaches away from the claimed invention.

Because Smith and Hopper teach away from the present invention, they are not properly combined with Kawai and Hamada, and even if combined, these references would not have rendered the subject matter of claim 50 and depending claims 52 and 53. Therefore, claims 50, 52 and 53 are patentable over these references taken individually or in combination. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 50, 52 and 53 be withdrawn.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By ______________________

Stephen A. Soffen
Registration No.: 31,063
Ryan H. Flax
Registration No.: 48,141
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
2101 L Street NW
Washington, DC 20037-1526
(202) 785-9700
Attorneys for Applicants

Version With Markings to Show Changes Made

1. (Twice amended) A method for removing polymer etch residue from an etched opening in a silicon wafer device comprising:

forming an opening in an insulating layer, wherein a polymer etch residue remains within said opening after the opening forming step; and

contacting said opening with a plasma [generated from ammonia gas] to remove said polymer etch residue, said plasma generated from a gas consisting essentially of ammonia.

6. (Amended) The method of claim [5] 2, wherein said contacting is done at a temperature within the range of about 250-500° C.

14. (Amended) The method of claim 1, further comprising forming a conductive layer at [the] a bottom of said opening following said contacting step.

15. (Amended) The method of claim [5] 1, wherein said contacting step produces silicon nitride at [the] a bottom of said opening, said method further comprising removing said silicon nitride.

16. (Amended) A method for removing polymer etch residue from an etched opening in a silicon wafer device, comprising the steps of:

contacting said opening with an oxygen containing plasma, stopping said oxygen plasma contacting before said polymer etch residue is completely removed and thereafter contacting said opening with [ammonia gas] a second plasma, said second plasma generated from a hydrogen containing gas.

17. (Amended) The method of claim 16, wherein said contact opening is an High Aspect Ratio (HAR) opening, and said [ammonia] second plasma contacting step is

performed under conditions effective to remove said etch residue without substantially increasing the size of said opening.

18. (Amended) The method of claim 17, wherein said [ammonia] second plasma contacting occurs in the absence of oxygen.

20. (Amended) The method of claim [19] 18, wherein said [ammonia] second plasma contacting is performed at a temperature within the range of about 250 – 500° C.

21. (Amended) The method of claim [19] 18, wherein said [ammonia] second plasma contacting is performed in a reactor operating in a power range of about 500 – 5000 watts.

22. (Amended) The method of claim 20, wherein said [ammonia] second plasma contacting is performed at a temperature of about 350°C.

24. (Amended) The method of claim 21, wherein said [ammonia] second plasma contacting is performed at a flow rate within the range of about 100 to 4000 SCCM.

25. (Amended) The method of claim 15, wherein said [ammonia] second plasma contacting is performed for a period of time sufficient to remove said residue from a bottom of said opening.

26. (Amended) The method of claim 25, wherein said bottom of said opening is not oxidized during said [ammonia] second plasma contacting step.

29. (Twice amended) A method of forming a contact opening in a semiconductor device, comprising:

a) etching a contact opening in an insulative layer in said device down to a polysilicon element of said device; [and]

b) contacting said opening with an oxygen plasma to remove a portion of said etch residue; and

c) cleaning etch residue from said etched opening by contacting said opening with [ammonia gas in the form of] a plasma generated from a hydrogen containing gas in the absence of added oxygen.

37. (Amended) The method of claim 34, wherein said contacting is performed [with an ammonia gas] at a gas flow rate of 750 SCCM.

50. (Amended) A method of forming an integrated circuit structure comprising:

forming an insulating layer over a polysilicon region;

forming a high aspect ratio contact opening in said insulating layer down to said polysilicon region using a fluorine containing gas;

removing polymer residue from said contact opening using a plasma consisting essentially of ammonia gas which provides an oxide free bottom of said contact opening, and which does not substantially increase size of said opening;

forming a silicide layer at the bottom of said opening in contact with said polysilicon layer;

forming a conductor in said opening in electrical contact with silicide layer.

54. (New) A method for removing polymer etch residue from an etched opening in a silicon wafer device comprising:

forming an opening in an insulating layer, wherein a polymer etch residue remains within said opening after the opening forming step; and

contacting said opening with a plasma to remove said polymer etch residue; said plasma generated from a gas consisting essentially of hydrogen gas.

55. (New) The method of claim 54, wherein said opening is a High Aspect Ratio (HAR) contact opening.

56. (New) The method of claim 55, wherein said contacting is performed under conditions effective to remove said etch residue without substantially increasing the size of said opening.

57. (New) The method of claim 56, wherein said opening is contacted with hydrogen gas in the absence of oxygen.

58. (New) The method of claim 55, wherein said contacting is done at a temperature within the range of about 250 - 500° C.

59. (New) The method of claim 58, wherein said contacting is performed in a plasma reactor within a power reactor range of about 500 - 2500 watts.

60. (New) The method of claim 59, wherein said contacting is performed within a power range of about 1500 - 2000 watts.

61. (New) The method of claim 59, wherein said contacting is performed with a hydrogen gas flow rate within the range of about 500 to 1000 SCCM.

62. (New) The method of claim 61, wherein said contacting is performed at power of about 1900 watts and a temperature of about 350°C.

63. (New) The method of claim 62, wherein said contacting is performed with a hydrogen gas flow rate of about 750 SCCM.

64. (New) The method of claim 61, wherein said contacting is performed for a period of less than about 100 seconds.

65. (New) The method of claim 64, wherein said contacting is performed for a period of not more than about 75 seconds.

66. (New) The method of claim 54, further comprising forming a conductive layer at a bottom of said opening following said contacting step.

67.(New) The method of claim 54, wherein said contacting step produces silicon nitride at a bottom of said opening, said method further comprising removing said silicon nitride.

68. (New) The method of claim 54, wherein said plasma contacting is performed for a period of time sufficient to remove said residue from a bottom of said opening.

69. (New) The method of claim 54, wherein a bottom of said opening is not oxidized during said plasma contacting step.

70. (New) A method for removing polymer etch residue from an etched opening in a silicon wafer device comprising:

forming an opening in an insulating layer, wherein a polymer etch residue remains within said opening after the opening forming step; and

contacting said opening with a plasma to remove said polymer etch residue; said plasma generated from a gas consisting essentially of methane gas.

71. (New) The method of claim 70, wherein said opening is a High Aspect Ratio (HAR) contact opening.

72. (New) The method of claim 71, wherein said contacting is performed under conditions effective to remove said etch residue without substantially increasing the size of said opening.

73. (New) The method of claim 72, wherein said opening is contacted with methane gas in the absence of oxygen.

74. (New) The method of claim 71, wherein said contacting is done at a temperature within the range of about 250 - 500° C.

75. (New) The method of claim 74, wherein said contacting is performed in a plasma reactor within a power reactor range of about 500 - 2500 watts.

76. (New) The method of claim 75, wherein said contacting is performed within a power range of about 1500 - 2000 watts.

77. (New) The method of claim 75, wherein said contacting is performed with a methane gas flow rate within the range of about 500 to 1000 SCCM.

78. (New) The method of claim 77, wherein said contacting is performed at power of about 1900 watts and a temperature of about 350°C.

79. (New) The method of claim 78, wherein said contacting is performed with a methane gas flow rate of about 750 SCCM.

80. (New) The method of claim 77, wherein said contacting is performed for a period of less than about 100 seconds.

81. (New) The method of claim 80, wherein said contacting is performed for a period of not more than about 75 seconds.

82. (New) The method of claim 70, further comprising forming a conductive layer at a bottom of said opening following said contacting step.

83.(New) The method of claim 70, wherein said contacting step produces silicon nitride at a bottom of said opening, said method further comprising removing said silicon nitride.

84. (New) The method of claim 70, wherein said plasma contacting is performed for a period of time sufficient to remove said residue from a bottom of said opening.

85. (New) The method of claim 70, wherein a bottom of said opening is not oxidized during said plasma contacting step.

86. (New) The method of claim 16, wherein said hydrogen containing gas is ammonia gas.

87. (New) The method of claim 16, wherein said hydrogen containing gas is hydrogen gas.

88. (New) The method of claim 16, wherein said hydrogen containing gas is methane gas.

89. (New) The method of claim 30, wherein said hydrogen containing gas is ammonia gas.

90. (New) The method of claim 30, wherein said hydrogen containing gas is hydrogen gas.

91. (New) The method of claim 30, wherein said hydrogen containing gas is methane gas.

92. (New) A method of forming an integrated circuit structure comprising:

forming an insulating layer over a polysilicon region;

forming a high aspect ratio contact opening in said insulating layer down to said polysilicon region using a fluorine containing gas;

removing polymer residue from said contact opening using a plasma consisting essentially of hydrogen gas which provides an oxide free bottom of said contact opening, and which does not substantially increase size of said opening;

forming a silicide layer at the bottom of said opening in contact with said polysilicon layer;

forming a conductor in said opening in electrical contact with silicide layer.

93. (New) A method as in claim 92, further comprising removing a portion of said polymer residue from said contact opening with oxygen prior to using said gas which provides an oxide free bottom of said contact opening.

94. (New) A method as in claim 92, wherein said silicide layer is a titanium silicide layer.

95. (New) A method of forming an integrated circuit structure comprising:

forming an insulating layer over a polysilicon region;

forming a high aspect ratio contact opening in said insulating layer down to said polysilicon region using a fluorine containing gas;

removing polymer residue from said contact opening using a plasma consisting essentially of methane gas which provides an oxide free bottom of said contact opening, and which does not substantially increase size of said opening;

forming a silicide layer at the bottom of said opening in contact with said polysilicon layer;

forming a conductor in said opening in electrical contact with silicide layer.

96. (New) A method as in claim 95, further comprising removing a portion of said polymer residue from said contact opening with oxygen prior to using said gas which provides an oxide free bottom of said contact opening.

97. (New) A method as in claim 95, wherein said silicide layer is a titanium silicide layer.